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EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 12/09/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/922,122

Applicant(s)

MARCHAND ET AL.

Examiner

Matthew J Song

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— The MAILING DATE of this communication appears on the cover sheet with the correspondence address —

**Period of Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) 18-34 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election with traverse of Group I, claims 1-17, in Paper No. 7 is acknowledged. The traversal is on the ground(s) that the process would not make the claimed product, since the product claim specifically recites the limitation for the basis of the restriction. This is not found persuasive because the claims of Group I are directed to a product, although claim 1 specifically recites the process limitation, the patentability determination of a product-by-process claim is based on the patentability of the product does not depend on its method of production (MPEP 2113). In this case the product can be formed by another materially different process, such as one with an interruption in the supply to form the product claimed. Also a serious burden exists in the differing issues likely to arise during the prosecution of the different statutory classes of the invention.

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 18-34 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 7.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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4. Claims 11-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 11 recites the limitation “high aluminum composition” in line 1, “high” is indefinite, likewise for claim 12.

5. Claims 13-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 13 recites the limitation “low aluminum composition” in line 1, “low” is indefinite, likewise for claim 14.

6. Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 recites “a substantially continuous grade”. The term “substantially” is indefinite.

***Claim Rejections - 35 USC § 102***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Edmond et al (US 5,739,554).

Edmond et al discloses a buffer layer 42 can comprise a graded layer of AlGa<sub>N</sub> that is substantially entirely aluminum nitride where it meets the SiC substrate 42 and then is progressively graded with increasing amounts of gallium until it is substantially entirely gallium nitride at its upper surface where it meets the n-type layer of gallium nitride 43 (Fig 2 and col 7, ln 1-67), this progressively graded layer reads on applicant's varying composition of substantially continuous grade.

Applicant is reminded that claims 1-15 are product by process claims and are not limited to the manipulations of the recited steps, only the structure of the implied steps. Even though the product-by-process claims are limited by and defined by the process, determination of the patentability is based on the product itself. If the product in the product by process claim is the same or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (MPEP 2113).

Referring to claim 2, 4-9, the instant claims only further limit the process of the invention. Edmond et al teaches the structure of instantly claimed product.

Referring to claim 3, Edmond et al discloses a graded AlGa<sub>N</sub> layer from an AlN layer to a GaN, but is silent to the graded gallium nitride layer has a net compressive stress. It is inherent to Edmond to have a net compressive stress because the differences in lattice constant throughout the graded layer inherently causes compressive stress.

9. Claims 1-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Redwing et al (US 5,874,747).

Redwing et al discloses a method of forming a graded (Al,Ga)N buffer on a SiC substrate wherein the Al content is graded from AlN at the substrate to GaN at the top, this reads on applicant's varying composition of a substantially continuous grade. Redwing et al is also discloses an initial TMAI flow rate and a final flow rate were chosen that would give the same growth rate and TMAI flow rate is supplied without interruption (Example V and Fig 20). Redwing et al also discloses the graded layer could also be made of (Al,In)N or (Al,Ga,In)N (col 19, ln 1-67). Redwing et al also discloses a compositionally graded GaN layer may comprise a compositionally graded  $\text{Al}_x\text{Ga}_{1-x}\text{N}$  buffer layer between gallium nitride and a silicon carbide layer and the buffer layer is compositionally graded from an interface of the buffer layer with a silicon carbide layer at which x is 0 to an interface of the buffer layer with a gallium nitride layer at which x is 1 (col 7, ln 1-67).

Referring to claim 2, Redwing et al is silent to MOCVD. It is inherent to Redwing et al to deposit the graded gallium nitride layer using MOCVD because Redwing et al teaches deposition of a graded gallium nitride layer using metal organic (MO) precursors.

Referring to claim 3, Redwing et al discloses a graded AlGaIn layer from an AlN layer to a GaN, but is silent to the graded gallium nitride layer has a net compressive stress. It is inherent to Redwing et al to have a net compressive stress because the differences in lattice constant throughout the graded layer inherently causes compressive stress.

Referring to claims 4-7, Redwing et al disclose changing the total flow of precursors (Fig 20).

Referring to claims 2 and 3-17, Applicant is reminded that claims 1-17 are product by process claims and are not limited to the manipulations of the recited steps, only the structure of

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the implied steps. Even though the product-by-process claims are limited by and defined by the process, determination of the patentability is based on the product itself. If the product in the product by process claim is the same or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (MPEP 2113).

Referring to claim 10-11, Redwing et al discloses a high aluminum content layer of AlN on a silicon carbide substrate graded to a GaN layer with a GaN layer deposited thereon.

Referring to claims 16-17, Redwing et al discloses an AlGaInN graded layer.

### ***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Edmond et al (US 5,739,554) in view of Goetz et al (US 6,441,393).

Edmond et al discloses all of the limitations of claim 15, as discussed previously, except at least one other element is introduced into the growth chamber for the graded gallium nitride.

In a method of forming semiconductor devices with doped III-V nitride layers, note entire reference, Goetz et al teaches III-V nitride layers made of doped GaN, InGaN or AlGaInN and the composition and/or doping of the various layers may be smoothly graded over a finite thickness or may be graded over the entire thickness of the layer. Goetz et al also teaches a Si dopant (col 3, ln 1-67 and col 4, ln 1-67). It would have been obvious to a person of ordinary skill in the art

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at the time of the invention to modify Edmond et al with Goetz et al because donor species are introduced simultaneously to stabilize the structural integrity of a heteroepitaxially grown III-V nitride on lattice mismatched substrates (col 5, ln 30-65).

### ***Conclusion***

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Yoshida (US 5,496,767) teaches a compressive stress is applied to an active layer by a strain due to a difference between lattice constants of the active layer to a substrate (col 1).

Kamiyama et al (US 6,324,200) teaches adding arsenic to the composition of a Group III-V nitride semiconductor results in a shallower acceptor level, as compared to nitride semiconductors without added Arsenic (col 10, ln 1-67).

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.




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Matthew J Song  
Examiner  
Art Unit 1765

MJS  
December 4, 2002

  
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